



A PILOT DVD PROJECT

MEIOSIS MISHAPS

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Activity 2: The SRY Gene and Genetic Identity

Time Frame: 2 hours (Can be performed in a typical double block period or over two consecutive single class periods)

Materials: HHMI Lecture *The Meaning of Sex* (Nov. 2001), copies of student handouts, overhead projector with teacher overhead transparencies.

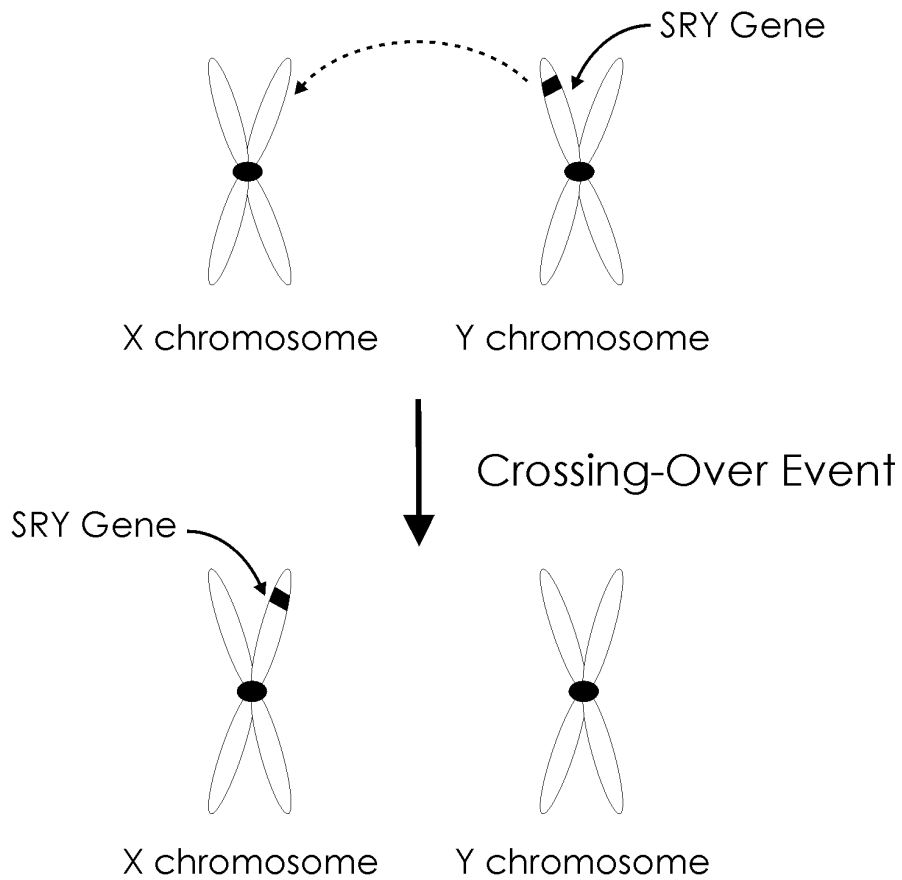
Teacher Directions:

The lesson is an analysis of mutations at the gene level on sex chromosomes, and how the SRY gene can cause XX males and XY females.

- Introduce the lesson by reviewing concepts of meiosis and nondisjunction. It is assumed that students have performed the activity on nondisjunction or are familiar with its concepts
- Discuss the history of the discovery of sex chromosomes
 - Show DVD Lecture 1, Chapters 10-14
 - Ask students what determines sex or gender.
 - Have students comment on the identification of external sex organs as a determination of gender
- Introduce the SRY gene by showing DVD Lecture 1, Chapter 15
 - Ask students how the SRY gene influences or determines gender
 - Have students predict how the SRY gene could make XX males or XY females
 - Show DVD Lecture 1 Chapters 31-33
- Use Black line 6 *Crossing of the SRY Gene* as an overhead transparency to demonstrate how crossing-over moves the SRY gene correctly or incorrectly
 - Ask students to describe the mechanism that causes SRY+ or SRY- during crossing-over
 - Have students comment on their understanding of sex determination as influenced by the SRY gene
 - Ask students to predict if any genetic testing is done at the Olympics, and comment on its importance
- Distribute Black line 7 *Student Copy of Gender Testing Interactive Activity* as a worksheet for the student activity. Students are to make comments and write answers on the worksheet as they participate in the interactive activity on gender testing
 - Show the interactive activity on gender testing from DVD, found in the DVD Extras area from the main menu.
 - Read aloud or have student volunteers read the information presented on each screen
 - Pause and have students answer and give reasons on the worksheet when asked to determine gender, etc.
 - They will answer several times during breaks in the activity based on physical examination, karyotyping, SRG gene, etc.
- Conclude the lesson with a discussion of what it means to be male or female, based on our present knowledge of genetics. Students evaluate and write comments on worksheet

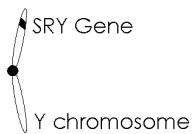
Evaluation: Students complete Black line 7 as an assessment (Use teacher copy for answers)

Extensions: Have students research and report on other disorders caused by errors in sex chromosomes. Students could also investigate the current standards of genetic testing in popular sporting events such as the Olympics.

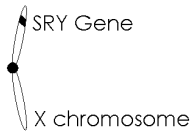


→ 3 Possibilities

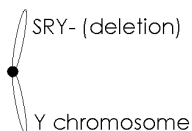
- XY ♂ = Normal Male



- XX ♂ = Looks male but has XX



- XY ♀ = Looks female but has XY



BLACKLINE 7 STUDENT COPY GENDER TESTING INTERACTIVE ACTIVITY

FRAME 1: RESULTS OF PHYSICAL EXAM

- External genitalia _____
- Secondary sex characteristics _____
- Other characteristics _____
- Is Jane Doe male or female? _____

FRAME 2: KARYOTYPE ANALYSIS

- What is a karyotype? _____
- What does Jane Doe's karyotype show? _____
- Your conclusion: _____ male _____ female

FRAME 3: EARLY SEXUAL DEVELOPMENT IN HUMANS

- What is meant by "bipotential"?

FRAME 4: SRY GENE ON THE Y-CHROMOSOME

- What is the SRY gene responsible for triggering? _____
- Can the other "male" genes on the Y-chromosome turn on if the SRY gene is absent? _____ explain _____

FRAME 5: TESTING FOR SRY

- How is it possible for Jane to have the appearance of a woman and have a Y-chromosome? _____

FRAME 6: PCR TEST RESULT

- Does Jane have a functional SRY gene? _____
- Your conclusion: _____ male _____ female

FRAME 7: EXPLAIN WHY YOU HAVE CHOSEN MALE OR FEMALE _____

FRAME 8: What is your final decision in qualifying or disqualifying Jane as a female competitor?
_____ qualify _____ disqualify

Explain why you made this decision. Which information was most convincing? _____

FRAME 9: what is Jane Doe's condition called? _____

- Describe this abnormality _____

FRAME 10: what is the international consensus regarding this particular condition? _____
Do you agree with it? _____

FRAME 1: RESULTS OF PHYSICAL EXAM

- External genitalia Present and fully formed
- Secondary sex characteristics Breasts. No chest or facial hair
- Other characteristics Sparse underarm and pubic hair
- Is Jane Doe male or female

FRAME 2: KARYOTYPE ANALYSIS

- What is a karyotype? Specially arranged snapshot of all chromosomes in a single cell
- What does Jane Doe's karyotype show? An X and Y chromosome
- Your conclusion: male female

FRAME 3: EARLY SEXUAL DEVELOPMENT IN HUMANS

- What is meant by "bipotential"? An embryo has bipotential prior to the expression of the SRY gene, which is what starts differentiation between the sexes.

FRAME 4: SRY GENE ON THE Y-CHROMOSOME

- What is the SRY gene responsible for triggering? Male development. Codes for a transcription factor which turns other genes on or off.
- Can the other "male" genes on the Y-chromosome turn on if the SRY gene is absent? No Explain The other genes are turned on by the SRY gene and cannot be turned on if it is not present.

FRAME 5: TESTING FOR SRY

- How is it possible for Jane to have the appearance of a woman and have a Y-chromosome? If the SRY gene is not functional, Jane can develop as a female.

FRAME 6: PCR TEST RESULT

- Does Jane have a functional SRY gene? Yes
- Your conclusion: male female

FRAME 7: Explain why you have chosen male or female Answers will vary

FRAME 8: What is your final decision in qualifying or disqualifying Jane as a female competitor?
 qualify disqualify

EXPLAIN WHY YOU MADE THIS DECISION. WHICH INFORMATION WAS MOST CONVINCING? Answers will vary.

FRAME 9: What is Jane Doe's condition called? Complete androgen insensitivity syndrome (CAIS)

- Describe this abnormality The SRY gene is functional but male development stops at another point in the complicated process.

FRAME 10: what is the international consensus regarding this particular condition? People with this condition are considered female.

Do you agree with it? _____